

100 **Tibetan antelope traditional hunting, its relation to antelope migration, and its**  
101 **rapid transformation in the western Chang Tang Nature Reserve**

102

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111

112 **Abstract:** On the western Tibetan Plateau the endangered Tibetan antelope *Pantholops hodgsoni*  
113 has traditionally been hunted for subsistence purposes. Although several hunting techniques are  
114 used, a common one that leaves evidence on the landscape is the use of earth or stone  
115 diversionary barriers, or drive-lines, with both leg-hold traps and hiding depressions used for  
116 shooting being associated with the barrier bottlenecks. Within the western Chang Tang Nature  
117 Reserve on the northwest Tibetan Plateau we located 45 examples of these generally funnel-  
118 shaped trap systems near the northern limits of human habitation in Gertse and Rutok Counties,  
119 Ngari Prefecture, Tibet Autonomous Region, China. The more recently maintained drive-lines  
120 were located farther to the north, and many of the southern ones we observed had, according to  
121 locals, not been used in many years, as hunting activity has apparently moved northward.  
122 Increasing human population and settlement of northern areas, new pastoral land-tenure  
123 arrangements and associated fencing, as well as modern techniques for hunting antelope and  
124 increased markets for their fine wool are all changing the human-wildlife dynamic at the northern  
125 edge of human habitation in the Chang Tang. Such new developments are likely to soon result in  
126 a relegation of the nomadic pastoralists' hunting practices discussed here to a tradition of the  
127 past.

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129 **Keywords:** Tibetan antelope, chiru, traditional hunting, traplines, Tibetan Plateau, Chang Tang

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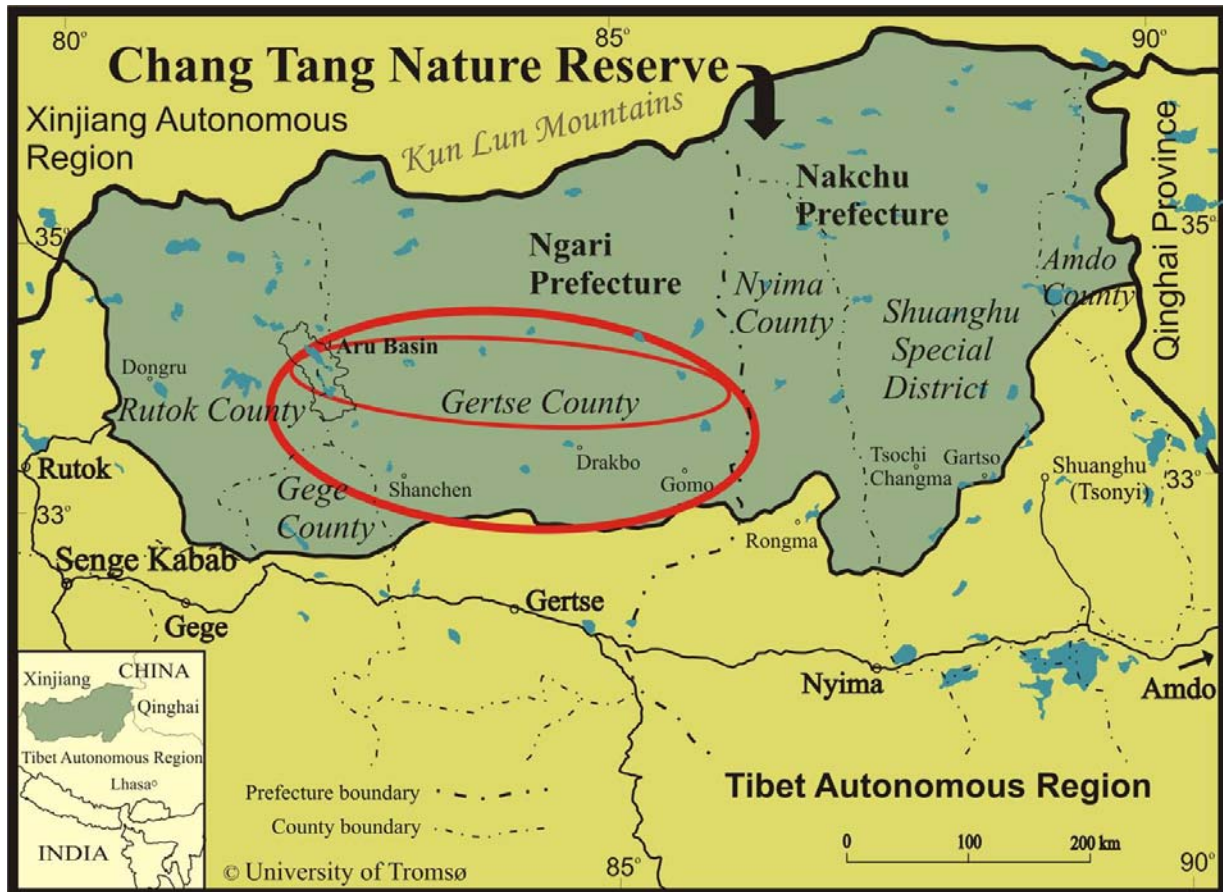
132 **Introduction**

133  
134 Across the northwest Tibetan Plateau there are still substantial populations of the endangered  
135 Tibetan antelope *Pantholops hodgsoni*, with many animals migrating between calving areas at  
136 the plateau's northern boundary, the Kun Lun Mountains, and wintering sites to the south at  
137 about 33°-34° N (Schaller 1998). This region is part of what is known as the Chang Tang  
138 ('northern plains'), 300,000 km<sup>2</sup> of which in the northwest part of the Tibet Autonomous Region  
139 was designated as a nature reserve in 1993 (Fig 1). Tibetan antelope have been hunted in the  
140 Chang Tang for at least the past 20,000 years (Brantingham et al. 2001), and since pastoralists  
141 arrived on the plateau some 3,500-4,000 years ago (Barfield 1989) there has been a combined  
142 hunting and herding lifestyle in areas of wildlife abundance. There is isolated evidence of pre-  
143 Buddhist pastoralist habitation a little north of 33° N in the western Chang Tang (D. Lhagyal,  
144 pers comm.), as is more common farther to the south in the large lakes region of the southern  
145 Chang Tang (Bellezza 1997). Nevertheless, permanent human habitation and concomitant  
146 pastoralism, was apparently very limited north of about 33° 30' N in the western Chang Tang until  
147 the 1700's when groups emigrated there from the northeastern Tibetan plateau (Fox and Tsering  
148 2005, Huber 2005), and even today areas above about 34° are still generally uninhabited. In the  
149 late 1800s and early 1900s explorers visiting this area commented (e.g., Hedin 1909) on herding  
150 and hunting lifestyles to the north of Gertse town.

151 The Tibetan antelope has traditionally been hunted using several techniques and in all seasons  
152 (Huber 2005), but most hunting is associated with winter when the large migratory populations  
153 come to southern areas for mating. The exact locations of one hunting style, very distinctive in its  
154 use of long diversionary barriers, or drive-lines, can be documented on the ground, and we use  
155 these here to illustrate the distribution of such hunting across a part of the western Chang Tang.  
156 Because these traditional hunting devices are currently being abandoned, their cultural  
157 significance and documentation of their locations are of interest. In recent decades, the traditional  
158 subsistence meat hunting has combined with cash incentives associated with international  
159 demand for antelope wool or "shahtoosh" (Kumar and Wright 1998) to substantially increase  
160 hunter take in the Chang Tang, and hunting techniques have been rapidly changing. These  
161 changes in hunting, combined with modernizing lifestyles and introduction of new livestock

162 management initiatives, are greatly changing the relationship between people and wildlife in the  
 163 western Chang Tang (Fox et al. in press, Fox et al. in review).

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167 **Figure 1. The Chang Tang Nature Reserve in the northwest Tibetan Autonomous Region. The large**  
 168 **oval indicates the general region surveyed, and the smaller oval the area with most trapping**  
 169 **locations.**

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## 172 Study Area and Methods

173

174 The investigations reported here were carried out within a ca. 70,000 km<sup>2</sup> area of northern Gertse  
 175 County, and small parts of both Rutok and Geji Counties, within Ngari Prefecture in the  
 176 northwestern Tibetan Autonomous Region of China (Fig. 1). Other than the Aru Basin (Schaller  
 177 1998, Fox et al. 2004), this area has not previously received attention regarding antelope  
 178 distribution, abundance and conservation. Huber (2005) has described the various antelope

179 hunting techniques used in northern Gertse County, and provides detailed descriptions of the  
180 hunting/trapping aids used in this area. We provide a more extensive overview of the distribution  
181 and shifts in use of these game-drive structures, and their relationship to migratory patterns of  
182 antelope in the region.

183  
184 Our results are based on five 2-6 week excursions to the northwestern Chang Tang during 2000-  
185 2002 and 2005-2006, with the first 3-year period primarily in the vicinity of the Aru Basin on  
186 both sides of the boundary between Gertse and Rutok Counties, and the 2005-2006 fieldwork  
187 including extensive surveys of the northern limit of inhabited areas across Gertse County.  
188 Abundance results from the antelope population surveys are referred to here, but reported in  
189 detail elsewhere (Fox et al., in review). We questioned many nomads and local officials regarding  
190 hunting activities, but most of the anecdotal information reported here is based on interviews  
191 with eight men between the ages of 58 and 78 who had experience with large mammal hunting in  
192 the northern Chang Tang, six from Gertse County, one from Geji County and one from Rutok  
193 County. These men, and some other younger individuals, gave us general information on the  
194 location of hunting areas, antelope mating areas and migration routes, and often accompanied us  
195 on journeys to inspect these sites. The Aru Basin and its vicinity was the most thoroughly  
196 searched area for evidence of hunting, whereas a 2005 excursion, and a shorter foray in 2006  
197 across parts of northern Gertse County at ca. 34° N provided less detailed but more extensive  
198 searches.

199

200

## 201 **Results and Discussion**

202

203 There are a number of different approaches to antelope hunting, depending on season and animal  
204 behavior (Huber 2005). But in general, most antelope hunting traditionally takes place primarily  
205 during the winter period when herds congregate in large numbers for breeding. Hunters  
206 sometimes construct small (2-3 m diameter) hiding depressions (Fig. 2) near water sources in  
207 antelope wintering (mating) areas. We have found only a few examples of these depressions, in  
208 open flat areas; the one in Fig. 2 was found in 2005 and showed signs of recent maintenance. In  
209 hilly areas small rock-wall blinds are occasionally used for hunting, although these can serve

210 equally well as wind shelters for livestock herders. Prior to the introduction of muskets, there is  
211 ample evidence in rock carvings (Bellezza 2000) that the use of bow and arrow was the primary  
212 means of hunting. In any case, before and after muskets, the winter hunting was conducted  
213 primarily by shooting from concealed locations, either natural landforms that provided  
214 concealment, or through the use of these man-made shelters, or depressions in flat open areas.  
215



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218 **Figure 2. Hunter hide in Tibetan antelope wintering area, constructed near a winter water source in**  
219 **eastern Gertse County at about 34°N.**

220  
221 More prominent on the landscape, although still often difficult to recognize in the vast basins, are  
222 characteristic man-made constructions used for directing antelope movement to trapping and  
223 shooting sites. These funnel-shaped game drive structures (Fig. 3) are used primarily in the spring  
224 migratory staging areas, as female antelope gather and begin their northward calving migration.  
225 One of these traditional barrier trap systems, or “dzaekha”, and associated hunting activity has  
226 been described in some detail by Huber (2005). The diversionary lines are usually many hundreds  
227 of meters in length, up to several kilometers, and some people reported that the largest are over  
228 five km in length. We surveyed the full extent of only a few “dzaekha”; our locations were at the  
229 neck where possible, but many locations reflect our passing through just one part of the structure.  
230 The diversionary lines sometimes consist of just 10-20 cm high piles of dirt or sand, but usually  
231 rocks are placed upright on top of the piles, and sometimes only large rocks are used, i.e. without  
232 the dirt piles (Huber 2005, J.L. Fox, unpubl. data), but we have seldom encountered any part of  
233 the structures over 30 cm in height. Wild reindeer or caribou *Rangifer tarandus* are known to  
234 have been directed to hunting sites with funnel-shaped series of rock cairns or rock walls in North  
235 America (Brink 2005), Greenland (Grønnow et al. 1983) and northern Europe and Asia (Ingold

236 1980), and the photo of one from northern Canada shown in Fig. 10 of Brink (2005) is strikingly  
237 reminiscent of the “dzaekha”, although on a somewhat smaller scale. Also, the pronghorn  
238 antelope *Antilocapra americana* of North America were sometimes guided to hunting sites with  
239 drift fences and corrals (Lubinski 1999, McCabe et al. 2004), as were other ungulates in the  
240 Rocky Mountains (Benedict 2005), and similar hunting techniques were used in other parts of the  
241 world. It is interesting, however, that the low height of these “dzaekha” suggests that Tibetan  
242 antelope are somewhat unique in refusing to cross such low barriers.

243



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245

246 **Figure 3. Funnel-shaped game drive structures, locally known as “dzaekha”, used to force Tibetan**  
247 **antelope into small narrow areas for trapping and shooting. Each photograph is taken from the**  
248 **narrow neck area of the structure, and shows only one of the barrier lines.**

249

250 Small hiding depressions are sometimes constructed near either side of the neck of the “dzaekha”  
251 (Fig 4, far right), for shooting animals coming through the barrier’s neck; the maximum we have  
252 seen at one “dzaekha” was four, two on each side. These depressions are smaller than the one at  
253 the water source site in Fig. 2, since fewer hunters would be present at a single “dzaekha”. Also  
254 commonly placed within the neck of the “dzaekha” are small locally-made leg-hold traps or  
255 “khogtse”, constructed from antelope horn, plant material and animal hair (Fig. 4, left); see Huber  
256 (2005) for a description of its construction. Several of the former hunters we interviewed recalled  
257 various activities typical of the spring hunt in antelope migration staging areas, conducted in  
258 teams of 6-8 persons, where either the “khogtse” traps were used in funnel necks of the  
259 “dzaekha” or the hunters hid themselves nearby with their rifles ready, and this represents  
260 somewhat larger spring hunting groups than previously reported by Huber (2005). Hunters place  
261 a number (reportedly anywhere from 30-140) of these “khogtse” below the ground surface within  
262 the neck of the “dzaekha”, frozen into or anchored to the ground. Once caught in the trap the  
263 animal is either shot, killed with a knife, or is left to die on its own. In very large “dzaekha” there  
264 are sometimes two neck openings, an inner one where the hunters dig depressions for shooting,



265 and another outer neck where they lay the traps. “Khogtse” are also sometimes placed in well-  
 266 used antelope migratory trails, or around their winter watering sites, but they are intimately  
 267 associated with the “dzaehka” hunting technique.

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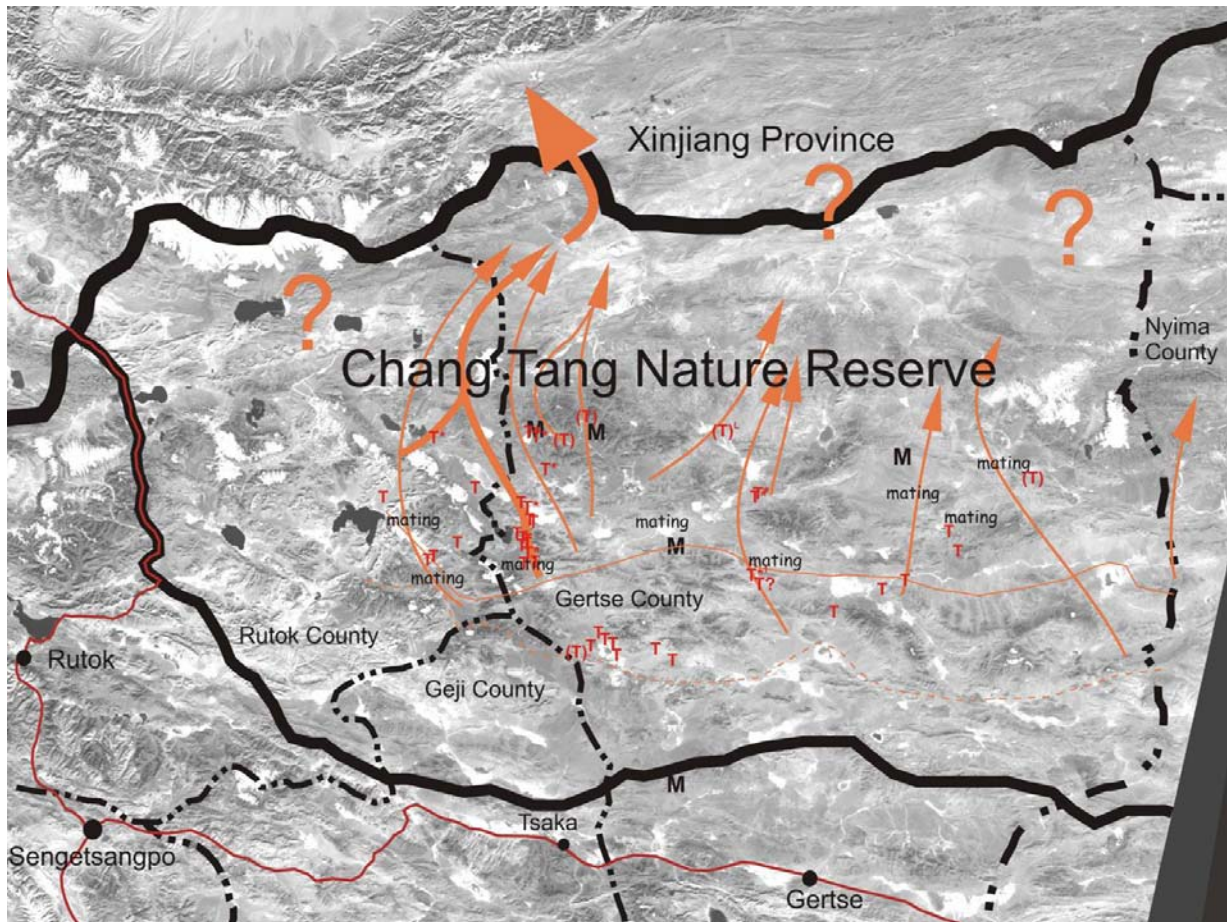
271 **Figure 4. Tibetan antelope leg-hold trap or “khogtse” (left, 18 cm diameter), nomad hunter with**  
 272 **home-made muzzle-loading musket (middle), and one side of diversionary trap barrier system with**  
 273 **a hunter hiding depression located near the narrow neck area of the diversion (right). The double-**  
 274 **pointed extension to the hunter’s musket is a stand for steadying the gun when shooting, and is**  
 275 **occasionally made with antelope horns.**

276

277 **“Dzaekha” locations** - We located 39 “dzaekha” in northern Gertse County, and 6 in Rutok  
 278 County (Fig. 5, Appendix I, and Fig. 1 for county boundaries). Their condition varied from  
 279 recently maintained to disused with only remnants remaining, and a few of the old sites were near  
 280 current settlements and well-known to local communities. There are certainly more “dzaekha”  
 281 present in the northern areas of Gertse and Rutok County surveyed here, which we did not locate,  
 282 but the present assemblage provides ample examples of their variety, and sufficient evidence to  
 283 document a recent northward shift in the use of these hunting aids. The landscape and layout of  
 284 one of the “dzaekha” reported here (**T<sup>1</sup>** in the center of Fig. 5) has earlier been described in some  
 285 detail (Huber 2005) and represents one of those that has received relatively recent maintenance;  
 286 the others showing recent maintenance are marked with an asterisk (**T\***). We did not visit the  
 287 largest “dzaekha” in Gertse County, known to many former hunters, but its approximate location  
 288 is designated as **T<sup>L</sup>** in the center of Fig. 5.

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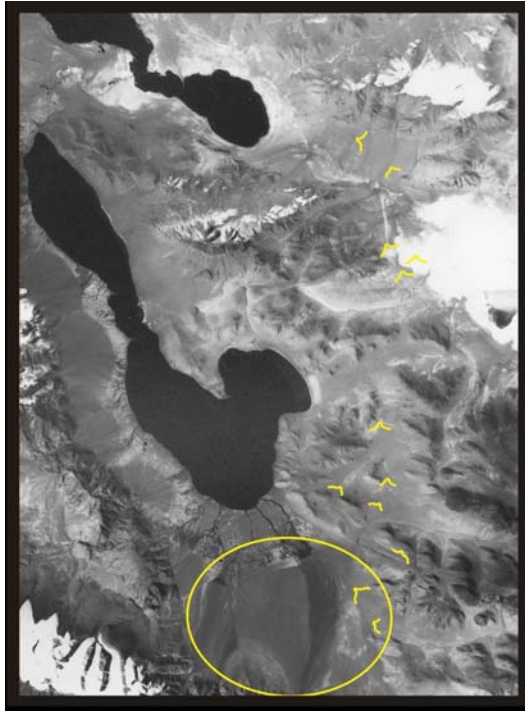
291  
 292 **Figure 5. Locations of “dzaekha”, diversionary trap systems for Tibetan antelope, in northern**  
 293 **Gertse and Rutok Counties, Ngari Prefecture, Tibet Autonomous Region, China. The T’s are trap**  
 294 **sites, those in parentheses are locations visually pointed out to us by locals but which we did not**  
 295 **visit. Migratory routes for female Tibetan antelope were described and pointed out to us by local**  
 296 **herders and/or former hunters. The thick arrows represent a known major migratory route to a**  
 297 **known calving area, whereas the question marks indicate current lack of knowledge regarding the**  
 298 **northern portion of migration routes and calving area destinations.**

299  
 300 Placement of the “dzaekha” is associated primarily with initial antelope travel from staging areas  
 301 where females congregate to begin their calving migrations to the north, but a few appear to be  
 302 situated along the early parts of migration routes, especially in sites constricted by topography.  
 303 Most of the “dzaekha” we encountered did not show indication of recent maintenance, with the  
 304 exception, however, of seven northern sites that have evidence of recent mound repair or rock  
 305 (re)placement. Most all “dzaekha” we encountered had their openings oriented in a northerly



306 direction (Appendix I), or along land formations that led to northern openings, and this is  
 307 illustrated from a small area of “dzaekha” concentration in the vicinity of an antelope staging area  
 308 within and near the Aru Basin (Fig. 6).

309



310  
 311 **Figure 6. Intensive antelope trapping area southeast of Memar (top) and Aru (center) Lakes in the**  
 312 **Aru Basin and vicinity of the northwest Chang Tang (see Fig. 1), showing the locations (large**  
 313 **asterisks) and orientation (small black drawings) of 12 “dzaekha”.** These sites are near the  
 314 **beginning of the female antelope’s northward calving migration. The large flat open area south of**  
 315 **Aru Lake (black oval) is a well-known antelope wintering, mating, and migratory staging area.**

316

317 The southernmost of the “dzaekha” we encountered were located within and near areas of current  
 318 permanent settlement, with some less than 200 m from current winter houses (all of which were  
 319 built within the past 15 years), none showed signs of recent maintenance, and some were clearly  
 320 only disused remnants. It thus appears that the areas of antelope winter concentration and  
 321 certainly their staging areas for the spring calving migration have shifted northward. The  
 322 existence of such a northward shift was confirmed in our interviews with the men experienced in  
 323 hunting, who virtually all agreed that areas of antelope concentration and overall numbers were  
 324 fewer in the more southern areas, and that such a change had occurred over the past 50 years or

325 so of their observation. Most persons interviewed were reluctant to comment on the current levels  
326 of hunting in the region, for the practice is illegal and under increasing levels of enforcement, but  
327 it was clear that some hunting continues at the northern sites (Fox et al., in review).

328

329 **Antelope migration routes** - Across the Chang Tang reserve, four major antelope long-distance  
330 migratory populations and their general migration routes have been reported (Schaller 1998),  
331 including that of the “Western Chang Tang herd” with staging areas to the east and south of Aru  
332 Lake and south of Lumajangdong Lake (large lake directly west of Aru Basin) (Fig. 1). This  
333 herd’s migratory path was first reported by Schaller (1998), and is the one which Ridgeway and  
334 his colleagues (Ridgeway 2003) followed on foot to a now well-described (Schaller et al. 2006)  
335 calving area (shown at the end of the thickest arrow in Fig. 5). This major migratory route is  
336 illustrated with the moderately thick arrow in Fig. 5, but animals from nearby wintering areas  
337 also join. When we followed this route north of the Toze Kangri massif (under the “g” in Chang  
338 in Fig. 5) in June of 2001, members of a mineral exploration team from Shanxi Province camped  
339 there reported to us their observation of numerous antelope groups migrating northward just to  
340 the east of this massif, presumably joining others en-route to the known calving area in Xinjiang  
341 (Fig. 5). Schaller (1998) apparently did not observe such groups when he was there in 1992, but  
342 we now know that across northern Gertse County to the east of the Aru Basin, and unreported to-  
343 date, there are apparently 3 or 4 routes that antelope take in starting their northward migration  
344 (Fig. 5). Where these routes lead to calving areas is currently not known, and although several of  
345 our informants reported having seen, or heard stories of, calving far to the north, they could not  
346 give accurate locations.

347

348 Regarding wintering and migratory staging sites for the Western Chang Tang herd, an avoidance  
349 of the Aru Basin itself as an area of concentration was reported by Schaller from his work in the  
350 early 1990’s (Schaller 1998). But this is contradicted by our 2000 and 2002 observations of large  
351 late autumn and winter concentrations within the basin, local residents’ reporting of substantial  
352 numbers of antelope remaining in the basin throughout the winter (J.L. Fox et al. 2004, J.L. Fox  
353 unpubl. data, T. Dorji unpubl. data), as well as the “dzaekha” shown in Fig. 6. More recently,  
354 however, our 2005 and 2006 observations indicate a decreased use of the Aru Basin, with more  
355 animals to the east of the basin (and perhaps to the west, which was not surveyed) (J.L. Fox,

356 unpubl. data). Taken together, these observations indicate that areas of winter congregation, and  
357 subsequent spring migration staging, can change to some extent over time, and the various routes  
358 shown in Fig. 5 may show substantial differences in the amount of use from year to year. The  
359 limited evidence of recent “dzaekha” maintenance we found may therefore reflect changing areas  
360 of antelope wintering concentration and migratory routes, and therefore hunting activity. But  
361 such lack of recent maintenance may also reflect the increasing use of new hunting techniques, as  
362 described below.

363  
364 **Distribution of “dzaekha” use in the Chang Tang** – The historical presence of “khogtse” leg-  
365 hold traps are also known from other regions of the Tibetan plateau where antelope did but do not  
366 today occur, e.g. from northern Qinghai (Huber, 2005). But, whether they were there also  
367 associated with “dzaekha”, and migratory antelope, is unknown. To-date, “dzaekha” have not  
368 been reported from areas other than the western Chang Tang, but thorough searches have not  
369 been conducted. On travel to our western Tibet study area, we have noted the presence of stone  
370 remnants of what appears to be a “dzaekha” just north of Nam Co ( $32^{\circ} 12.9' N$ ,  $86^{\circ} 31.5' E$ , 5008  
371 m) in Nakchu Prefecture. This would presumably indicate the presence of a migratory antelope  
372 population, and in an area where antelope do not presently occur, in this case some 150 km east  
373 and south of their current range. Although game drive structures elsewhere that are similar to  
374 “dzaekha” are not necessarily associated with migratory ungulates, whether that association is  
375 present in the Chang Tang poses an interesting question. Antelope still occur to the south of the  
376 ancient  $32^{\circ} 30' N$  travel corridor across the Chang Tang (today, the main east-west road to  
377 Sengetsangpo), although these are apparently not long-distance migratory populations. With  
378 substantially greater evidence of past human habitation and cultural artifacts to the south of this  
379 road, perhaps hunting and other human activities sufficiently depleted populations and altered  
380 migration patterns of the antelope there that any long-distance movements were long-ago  
381 disrupted. But a total lack of evidence of “dzaekha” from other areas south of the road could  
382 support a conclusion that relatively diffuse and short basin-to-mountain movements were the only  
383 type of seasonal migration ever present in these southern parts of the antelope’s distribution. In  
384 any event, the only large antelope populations in the TAR still undergoing long-distance  
385 migrations today have wintering concentrations generally north of the  $33^{\circ} N$  parallel, and hunting  
386 in the Chang Tang has been, and is still, concentrated in these areas.

387

388 **Recent changes in hunting behavior**

389 Although current laws do not permit any hunting, low levels of individual resident hunting that  
390 involve subsistence procurement of small amounts of meat were tolerated in some areas, such as  
391 the Aru Basin, in recent years. But, the increased illegal take of antelope for their skins and  
392 consequent intensified overall law enforcement is eliminating even this informal subsistence  
393 alternative. The question has been raised regarding possible continuation of some subsistence  
394 hunting by residents in this region (Fox and Tsering 2005), but government policies, as well as  
395 the continuation of illegal hunting, appears to be ruling out such a possibility. All antelope  
396 hunting was declared as illegal at the time of the nature reserve's creation in 1993, and modern  
397 weapons were confiscated from residents in about 1995, and in 2002 attempts were made to  
398 confiscate all firearms (including the old muskets) and various leg-hold traps. Nevertheless,  
399 antelopes inside the reserve are still being hunted for their fine wool (Fox et al. in review; WWF  
400 2006), and although some traditional trapping is still involved, more commonly modern rifles are  
401 used (sometimes supplied by illicit traders) and very recently the use of motorcycles has come  
402 into play in chasing down animals (Fox et al. in review).

403

404 Furthermore, in the northernmost townships, new pasture allocation policies and associated  
405 administrative boundary fencing are being introduced within traditional areas of antelope winter  
406 congregation winter and across their migratory routes (Fox et al, in press), some in the vicinity of  
407 old “dzaekha” (Fig. 7). Such fencing, started in 2005 and increasing during 2006, may  
408 detrimentally affect Tibetan antelope mortality and movement patterns in a manner similar to  
409 what happened with the pronghorn antelope (*Antilocapra americana*) of western North America  
410 (O’Gara and Yoakum 2004). However, their current use in some places as modern “dzaekha”  
411 barriers, with motorcycles to herd and tire the antelope and rifles to dispatch them, point to a  
412 completely different pattern of interaction between some residents and the wildlife (Fox et al. in  
413 review).

414

415

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419 **Figure 7. One of the new (2005) and increasing number of grazing land division barbed wire-topped**  
420 **fences in the Chang Tang Nature Reserve, here spanning an entire valley (ca. 20 km) and passing**  
421 **within 1 km of an old “dzaekha” in Drakbo Township, Gertse County.**

422  
423 Although some form of subsistence-related hunting could conceivably be continued today for the  
424 northernmost residents of the Chang Tang, modernizations are happening so fast that its role is  
425 questionable. Various improvements to hunting, e.g., modern weapons and vehicles, and the  
426 continued high price for antelope skins make this a difficult proposition. In any case, a limited  
427 amount of subsistence hunting could probably constitute a viable management option for the  
428 northernmost pastoralists, if livestock numbers are restricted and commercial hunted eliminated.  
429 Still, given a rise in living standards for the resident pastoralists, religious sentiment against  
430 killing could well deter the hunting anyway. The high market value of antelope skins remains the  
431 key issue in hunting today. But even were hunting to be eliminated, as is being attempted,  
432 planned livestock development initiatives may be the most important factor to affect human-  
433 wildlife interaction in the future (Fox et al, in review). The end result is that the numerous  
434 “dzaekha” described here are quickly becoming remnants of a rapidly disappearing lifestyle, the  
435 dirt piles will erode and the scarce rocks used to form them may well become the corrals and  
436 houses of the future.

437

438

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440

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454

455

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